

## EXPLANATION OF PLATE V.

- Fig. 1. *Lycopodites Stockii*, Kidston, n. sp., nat. size: *a, b, c, d, f*. Sporangium-like leaves (?); *e*. Reniform sporangia of terminal cone.  
 Fig. 2. Leaf, enlarged, seen on fig. 1, *g*.  
 Fig. 3. Sporangium-like leaf (?), enlarged, seen on fig. 1, *a*.  
 Fig. 4. Small portion of stem, enlarged, showing leaf-cicatrices.  
 Fig. 5. *Lepidodendron rimosum*, Sternberg.

XVI.—*Synopsis of the Families of existing Lacertilia.*

By G. A. BOULENGER.

WHILST engaged in a revision of the Lizard-collection in the British Museum, I have felt the necessity of a thorough systematic rearrangement of the order Lacertilia. The classifications proposed by Duméril and Bibron and Gray, and now still generally in use, with slight modifications, are, on the whole, as unnatural as can be, and founded to a great extent on characters of pholidosis and physiognomy. Physiognomy is worth nothing as a guide in the formation of higher groups; as to the characters afforded by the scales I have convinced myself that they are very deceptive, and ought to be taken into consideration in the definition of families only when accompanied by other characters. Like Cope, whose lizard-families\* I regard as the most natural hitherto proposed, I shall lay greater stress on osteological characters and on the structure of the tongue. Special importance must also be attached to the presence or absence, and the structure, of dermal ossifications on the head and body, and these will be found to correspond with many other characters. Bocourt †, to whom is due the merit of having pointed out their systematic importance, did not realize the very great progress made by means of that character, the modifications of which he so ably illustrated, for he still maintains the artificial group Scincoïdiens, in spite of the objections of Cope, whose views are evidently confirmed by the researches of the French herpetologist.

The order Lacertilia, as restricted by Günther ‡, may be divided into two primary groups only, the Chamæleons on the one hand, and all the other Lizards on the other. The Amphisbæniæns, which by nearly all recent authors are sepa-

\* Proc. Acad. Philad. 1864, p. 224, and Proc. Am. Assoc. Adv. Sc. xix. 1871, p. 236.

† Mission Scient. Mexique, Rept. p. 476 (1881).

‡ Phil. Trans. Roy. Soc. clvii. 1867, p. 625.

rated as a suborder, or even as an order, I include among the true lizards, and regard them as a degraded type of the Teiidae, with which they are to some extent connected by the Chalcides and their allies. The principal characters which have been put forward in favour of their separation are:— (1) absence of interorbital septum; (2) absence of columella cranii; (3) very short mandible, causing the quadratum to be nearly horizontal; (4) division of the occipital condyle; (5) absence of postorbital and fronto-squamosal arches; (6) absence of scales. These characters, which are mostly negative, are not all constant throughout the group, and many will be found, to a greater or less degree, to be characteristic of all strongly degraded, burrowing forms, such as *Aniella* near the Anguidae, *Anelytrops* (*Typhline*) and *Dibamus* near the Skinks, &c. The importance of these characters justifies our placing the Amphisbænas in a separate family; but, in my opinion, not in a higher group, for the following reasons:—

1. The absence of interorbital septum also occurs in *Ophiognomon* among the Teiidae, and there is every gradation between the skull of that genus and that of higher members of the same family: besides *Aniella* and *Dibamus*, which belong to totally different families, also possess the same negative character.

2. The columella disappears gradually with the interorbital septum; it is hardly distinguishable in *Ophiognomon* and totally absent in *Aniella* and *Dibamus*.

3. The aberrant lower jaw, not in itself a very important character, is not even constant, the genus *Blanus* differing in that respect as much from the typical *Amphisbæna* as from a typical Lizard.

4. The division of the occipital condyle, also a character the importance of which ought not to be exaggerated, is not even constant, the Acrodont Amphisbænians forming exceptions.

5. The absence of postorbital and fronto-squamosal arches, which occurs in the most diverse groups of Lizards, cannot be regarded as more than a family character.

6. The naked integuments (if we may apply this term to the skin of the Amphisbænians with its soft scales) are not special to the group, but occur also in Geckos; and they are so closely approached by those of some Cercosaurine and Chalcidine Teiidae as to render any sharp distinction impossible.

On the other hand, characters such as are afforded by the tongue, which in all Amphisbænians is in every respect similar to that of the Cercosaurine and Chalcidine Teiidae,

the preanal pores of most Amphisbæniæ, and the anterior limbs of *Chirotes* are indicative of affinity to the Teiidae. Respecting the latter, it may be remarked that in the other Lacertilia which dispense with the limbs, the fore pair disappear before the hind pair, and this holds true for the Ophidiæ, the less modified type still showing rudiments of pelvis, whilst not one preserves any thing of the pectoral arch. A reverse process obtains in the Teiidae and Amphisbæniæ.

I have already put forward my objections to recognizing the suborder Nyctisauræ\*.

Having separated the Chamæleons, we are in presence of the large suborder of true Lizards. This I have divided into twenty families, which I regard as perfectly natural groups. But there is great difficulty in arranging these families in a line. Two characters seem to demand special attention—those of the lingual papillæ and the clavicle, as, excepting the Geckos and Eublepharidæ, they exactly correspond, *i. e.* the forms with smooth or villose tongue have a slender, non-dilated clavicle, whereas those with scaly tongue have the clavicle strongly dilated proximally and generally enclosing a foramen.

#### Order LACERTILIA.

##### Suborder I. LACERTILIA VERA.

A. *Tongue smooth, or with villose papillæ; clavicle dilated, loop-shaped proximally; no postorbital or fronto-squamosal arches.*

Fam. 1. GECKONIDÆ. Vertebræ amphicœlian; parietal bones distinct.

Fam. 2. EUBLEPHARIDÆ. Vertebræ proœlian; parietal single.

B. *Tongue smooth or with villose papillæ; clavicle not dilated proximally.*

Fam. 3. UROPLATIDÆ. Vertebræ amphicœlian; interclavicle minute; no postorbital or postfronto-squamosal arches.

Fam. 4. PYGOPODIDÆ. No postorbital or postfronto-squamosal arches; pre- and postfrontal bones in contact, separating the frontal from the orbit.

Fam. 5. AGAMIDÆ. Postorbital and postfronto-squamosal arches present; supratemporal fossa not roofed over by bone; tongue thick; acrodont.

Fam. 6. IGUANIDÆ. Postorbital and postfronto-squamosal arches present; supratemporal fossa not roofed over by bone; tongue thick; pleurodont.

Fam. 7. XENOSAURIDÆ. Postorbital and postfronto-squamosal arches present; supratemporal fossa not roofed over; anterior portion of tongue retractile.

Fam. 8. ZONURIDÆ. Postorbital and postfronto-squamosal arches complete; supratemporal fossa roofed over; tongue simple.

Fam. 9. ANGUIDÆ. Postorbital and postfronto-squamosal arches present; supratemporal fossa roofed over; body with osteodermal plates

\* Ann. & Mag. Nat. Hist. (5) xii. 1883, p. 308.

with irregular, arborescent, or radiating channels; anterior portion of tongue retractile.

Fam. 10. ANIELLIDÆ. No interorbital septum, no columella cranii, no arches.

Fam. 11. HELODERMATIDÆ. Postorbital arch present, postfronto-squamosal arch absent; pre- and postfrontals in contact, separating the frontal from the orbit.

Fam. 12. VARANIDÆ. Postorbital arch incomplete; postfronto-squamosal arch present; supratemporal fossa not roofed over; nasal bone single; tongue deeply bifid, sheathed posteriorly.

C. *Tongue covered with imbricate scale-like papillæ or with oblique plicæ; clavicle dilated proximally, frequently loop-shaped.*

Fam. 13. XANTUSIIDÆ. Parietals distinct; postorbital and postfronto-squamosal arches present; supratemporal fossa roofed over.

Fam. 14. TEIIDÆ. Postorbital and postfronto-squamosal arches present; supratemporal fossa not roofed over; no osteodermal plates.

Fam. 15. AMPHISBÆNIDÆ. No interorbital septum; no columella cranii; no arches; premaxillary single.

Fam. 16. LACERTIDÆ. Arches present; supratemporal fossa roofed over; premaxillary single; no osteodermal plates on the body.

Fam. 17. GERRHOSAURIDÆ. Arches present; supratemporal fossa roofed over; premaxillary single; body with osteodermal plates with regular channels (a transverse one anastomosing with perpendicular ones).

Fam. 18. SCINCIDÆ. Arches present; premaxillary double; body with osteodermal plates as in the preceding.

Fam. 19. ANELYTROPIDÆ. Premaxillary single; no arches; no osteodermal plates.

Fam. 20. DIBAMIDÆ. Premaxillary double; no interorbital septum; no columella cranii; no arches; no osteodermal plates.

#### Suborder II. RHIPTOGLOSSA.

Fam. 21. CHAMÆLEONTIDÆ.

The *Geckonidæ* and *Eublepharidæ*, which differ from all other families in combining a dilated clavicle with a simply papillose tongue, are well distinguished from each other by the vertebræ, which are amphicœlous in the former and pro-cœlous in the latter. As characters of minor importance may be mentioned the coossification of the parietal bones in the *Eublepharidæ*, while they remain distinct in the *Geckonidæ*, which are also distinguished, constantly I believe, by having one bone less in the mandible, the supra-angulare having coalesced with the angulare.

Next come the *Uroplatidæ*, which are now for the first time separated from the Geckos. Although agreeing in most respects with the latter, their sternal apparatus differentiates them widely; the clavicle is slender, not at all dilated, and the interclavicle is reduced to a minute bone. Except the chamæleons, all other lizards in which the pectoral arch is not

rudimentary have a large interclavicle. To this very important character is added another; the nasals are united into a single bone, a peculiarity which is found elsewhere only in the *Varanidæ* among recent lizards. A single genus, *Uroplates*, from Madagascar, is known.

After the *Uroplatidæ* I have placed the *Pygopodidæ* (= *Pygopidæ* + *Aprasiadæ* + *Lialisidæ* of Gray), which family is now based on new characters. They were formerly arranged with or near the "Scincoids," a view which cannot be maintained, since that group was an assemblage of forms having totally different affinities, and "Scincoids" will now be found scattered through the following families:—*Anguidæ* (*Anguis*, *Diploglossus*, &c.), *Aniellidæ*, *Leiidæ* (*Gymnophthalmus*, &c.), *Scincidæ*, *Anelytropidæ*, and *Dibamidæ*. The skull of the *Pygopodidæ* in its simplicity of structure approaches that of the *Geckos*, and the parietal bones remain distinct in all the genera except *Lialis*; the bones of the lower jaw are still more reduced in number, the angular, supra-angular, and articular having coalesced, a character by which they approach the snakes. The affinities of this little group are very obscure, and a complete investigation of their anatomy is highly desirable.

The two closely allied families *Agamidæ* and *Iguanidæ* remain as before.

The *Xenosauridæ* must be regarded as intermediate between the *Iguanidæ*, with which Peters was inclined to associate them, and the *Anguidæ*, near which they are placed by Cope.

The *Zonuridæ* correspond only in name with the *Zonuridæ* of Gray and most other authors. The members of Gray's *Zonuridæ* will be found in the following families:—*Anguidæ* (*Gerrhonotus*, *Pseudopus*, &c.), *Lacertidæ* (*Tachydromus*), *Gerrhosauridæ*. They have, like the *Anguidæ*, a villose tongue, though not retractile at the end, a slender clavicle, and in some the body even presents bony plates, which are destitute of symmetrical canals. As here understood, the *Zonuridæ* comprise the genera *Zonurus*, *Platysaurus*, and *Chamaesaura*.

The *Anguidæ* correspond to Cope's *Anguidæ* and *Gerrhonotidæ*, the differential characters of which latter group seem to me insufficient for family separation. As Cope has shown, this group is perfectly natural, though containing "Chalcidoid" and "Scincoid" forms, and an excellent illustration of how misleading it is to trust only to external characters. The "Scincoid" forms correspond to Bocourt's *Diploglossidæ*.

The family *Aniellidæ* was also established by Cope. I would regard it as a degraded form of the *Anguidæ*.

The *Helodermatidæ*, as already shown by Cope, have the greatest affinity to the Anguidæ, from which they are, however, well distinguished by the structure of the skull. The grooved teeth might be given provisionally as another family character. It would be highly important to have some information on the osteological characters of Steindachner's Lanthanotidæ, as there is reason to suspect they will enter this family.

The *Varanidæ*, which come last in the series of alepidote-tongued lizards, remain characterized as before, and form a perfectly isolated group.

We have next a series of families characterized by the peculiar scale-like lingual papillæ and the proximally dilated clavicle.

The *Xantusiidæ* are closely allied to the Teiidæ, but distinguished by the different skull and scarcely incised tongue.

The *Teiidæ* form a very natural group, comprising the Cercosauridæ, Chalcididæ, Chirocolidæ, Anadiadæ, and part of the Gymnophthalmidæ of Gray and the Tretioscincidæ of Bocourt. It thus contains "Lacertoid," "Chalcidoid," and "Scincoid" forms of the Dumérilian system, all passing into one another by insensible gradations and all agreeing in the structure of the skull, tongue, and pectoral arch. All are confined to the New World, whereas the analogous family *Lacertidæ* is restricted to the Old World. As mentioned above, I regard the Amphisbænidæ as strongly degraded forms of the Teiidæ.

I establish a family *Gerrhosauridæ* for *Gerrhosaurus*, which was formerly associated with the Zonuridæ, but which agrees closely with the Scincidæ, from which it is to be distinguished by the coalesced premaxillaries. Although the arrangement of the scales of the body is different from what we see in the latter family, the underlying dermal bony plates are precisely similar in their symmetrical canals.

The *Scincidæ* correspond to Cope's Scincidæ, Sepidæ, and Acontiidæ, and to Bocourt's group Aspidoscinciens, less the Diploglossidæ.

The *Anelytropidæ*, a small family so named by Cope and synonymous with the Typhlinidæ of other authors, are a degraded type of the Scincidæ, having completely lost the cranial arches—which, in some forms of the latter group, show a tendency to disappear—and also the osteodermal plates.

The *Dibamidæ*, characterized for the first time, and comprising only the genus *Dibamus*, go still further in the direction of degradation, and are exactly analogous in this series to the Aniellidæ in the other series.